action. The evidence of design may be irresistible in cases where we cannot indicate its limits. We can only infer with greater or less probability, according to circumstances, and especially according to relation to ends. Better evidence than that of exquisite adaptation of means to ends is seldom, if ever, obtainable of human intention, and in the nature of the case it is the only kind of evidence which is scientifically available in regard to superhuman intention. Now if means and ends are predicable of inorganic nature at all, it is only by remote and indirect implication; while in organic nature the inference is direct and unavoidable. With what propriety, then, can it be affirmed that organic nature furnishes no other and no better evidence of underlying intelligence than inorganic nature? The evidence is certainly *other*, and to our thinking *better*.

To make the contrary supposition tenable, it must be shown that natural selection scientifically accounts for the adaptation; that the survival of only the very best adapted, out of the brood of more or less adapted to the environment at the time, gives sufficient scientific explanation of the adaptability or actual adaptation of the organism. Certainly this has not yet been done, and it seems incredible that it ever will be. That organisms have undergone changes as the Darwinian theory predicates, and that these changes have been picked out and led on by natural selection, seems to me most probable. That the action of the environment in some wholly unexplained way induces organisms to movement and change which would not otherwise occur, is also probable; but such change appears to be a response of the organisms to the physical surroundings and stimuli. And this most important factor in the result receives no explanation from the natural selection which operates upon it or co-operates with it. In other words, real causes have been assigned under which, *given the requisite changes*, the actual diversity and adaptations of plants and animals must or may have come to pass. But none have been assigned under which the organisms *must* have responded in the ways they do, or have responded at all, to the influences of the environment. Yet this is the very gist of the matter. The whole tenor of Darwin's writings and many explicit statements assure us that he completely recognised this distinction, which less exact minds overlook. If this distinction is valid, then the conclusion is at least premature which affirms "that the argument from teleology has been dislodged by the theory of natural selection," and its special value, as derived from adaptations in organic nature, utterly and for ever destroyed."

ASA GRAY

Cambridge, U.S.

Intelligence in Animals

MR. ROMANES remarks in his book that there are few recorded instances of intelligence in bears; the following facts may therefore be worth recording:—In the Clifton Zoological Gardens there are two female Polar bears between two and a half and three years old, which came here quite young. One of these shows remarkable intelligence in cracking cocoa-nuts. A nut was thrown to-day into the tank; it sank a long way, and the bear waited quietly till after some time it rose a little out of her reach. She then made a current in the water with her paw, and thus brought it within reach. This habit has already been several times noticed in Polar bears. She then took it on shore, and tried to break it by leaning her weight on it with one paw. Failing in this, she took the nut between her fore-paws, raised herself on her hind-legs to her full height, and threw the nut forwards against the bars of the den, three or four feet off. She then again leant her weight on it, hoping she had cracked it; but failed again. She then repeated the process, this time successfully. The keeper told me she employed the same method to break the leg-bone of a horse. That this is the result of individual experience, and not of instinct, is clear from the fact that her companion has not learnt the trick of opening them thus, nor could this one do it when she first came. The method of throwing is precisely similar to that adopted by the Cebus monkey described by Mr. Romanes.

J. G. GRENFELL

Clifton College, Clifton, Bristol, January 15

On a Relation existing between the Latent Heats, Specific Heats, and Relative Volumes of Volatile Bodies

AS I do not find that the following relation between the latent heat of evaporation, the expansion undergone in changing into the gaseous state, and the specific heat of a volatile body has been previously pointed out; and as, if verified, it might be of some value in the determination of one or other of the above quantities I submit it, not however without considerable diffidence, to the readers of NATURE.

Briefly stated the relation stands thus—

The latent heat of gasification at constant pressure of any body, divided by the product of the relative volume of the gas and the specific heat of the body is approximately constant; or, if

λ = latent heat of gasification of any body,
v = relative volume of the gas; *i.e.* the vol. of the body on assuming the gaseous state compared with its vol. as a liquid,
s = specific heat of the body. Then

$$\frac{\lambda}{v \times s} = \text{const.}$$

The calculated value of this constant approximates to 0·8, as will be seen in the following table.

The letters λ, v, and s, heading columns 2, 3, and 4, have the same signification as above.

	λ.	v.	s.	$\frac{\lambda}{v \times s}$
Ether	91·11	228	·515	·775
Carbon disulphide	86·67	414	·235	·890
Wood spirit	263·7	651	·645	·628
Bromine	45·9	510	·107	·841
Oil of turpentine	68·73	204	·410	·837
Formic acid	169·0	548	·536	·575
Ethyl acetate	92·6	209	·527	·840
Methyl acetate	110·2	321	·507	·677
Butyric acid	114·67	271	·503	·841
Ethyl formate	105·3	241	·513	·851
Amyl alcohol	121·0	268	·587	·967
Acetone	129·7	339	·530	·736
Alcohol	208·0	456	·547	·833
Benzene	91·47	282	·395	·821
Chloroform	61·0	318	·232	·828
Perchloride of carbon.	47·0	263	·198	·902
Phosphorus trichloride	51.42	311	·209	·790
Methyl butyrate	87·33	273	·487	·657
Ethyl chloride	93·0	320	·427	·679
Ethyl iodide	46·87	317	·162	·914
Acetic acid	102·0	515	·503[1]	·393
Chloride of arsenic	46·5	324	·176	·813
Tetrachloride of tin	30·53	237	·148	·869
Water	537·0	1612	1·000	·333

It would appear then that the latent heat of a body may be considered as approximately proportional to the expansion of the body in vaporising and to its specific heat; and that the amount of heat required to convert a unit mass of the body at the boiling point from the liquid to the gaseous state, is equal to an amount of heat which would raise through one degree a quantity of the body in the liquid state which is approximately proportional to the expansion undergone by the liquid on evaporating.

It will be noticed that among the bodies instanced in the table there are some which appear to be very far indeed from according with the relationship in question. Notably acetic acid and water; of these, however, water presents so many peculiarities that perhaps it may be allowable to consider this as only adding one more to their number. In the case of acetic acid it is noteworthy that in plotting the curve of the latent heats of the group of acids of which acetic acid is a member, Favre and Silbermann found an irregularity arising from this body. It is, at any rate, possible that this irregularity may mean an error in the determination of the latent heat of this body.

Considering the difficulties which attend the accurate determination of latent heats, relative volumes, and specific heats of the several bodies, and that, of course, an error in any one of these will introduce inaccuracies into the constant, it may well be supposed that some, at least, of the variations noticeable in the results tabulated arise from inaccurate data. Further, there are in many cases two or more distinct determinations of these physical properties extant, of which one might be so selected in each case as to reduce the variations occurring in the constant to a minimum.

F. TROUTON

Trinity College, Dublin

The Gresham Funds

IN an account of a meeting of the Common Council of the City of London, held last week, I read in the *Times* that the

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[1] Varies with temperature of determination irregularly.

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Gresham Committee reported that they had agreed with the Mercers' Company upon a scheme by which the open area of the Royal Exchange should be roofed over at a cost of 10,000*l*. Does this mean that the funds of the Gresham Estate are particularly flourishing just now, or that they are to be burdened with a new liability which will indefinitely postpone the time when there may be a surplus to be devoted to that advancement of science which Sir Thomas Gresham had in view in forming Gresham College? It is not long since some of the bonds, which represent money borrowed on the Gresham Estate for the building of the Royal Exchange, were advertised for repayment out of its surplus annual income, which afforded a hope that a good time for the scientific part of Sir Thomas Gresham's bequest might be drawing nigh. The public would be glad to know whether this hope is to be falsified or not. W. B.

January 20

Siwalik Carnivora

May I ask space to thank your correspondents for their answer to my previous inquiries concerning collections of Siwalik fossils in England, (many of which I have not yet had an opportunity of visiting,) and to add that I am now about undertaking the description of Siwalik Carnivora for the Indian Government? All remains of this order are very scarce, and in general fragmentary, and every specimen is, therefore, important. If any specimens exist in any provincial collections, I should be very glad of any information regarding them, and if possible of the opportunity of describing them in my forthcoming memoir. Any specimens sent to me, to the care of Dr. H. Woodward, F.R.S., British Museum (Natural History), Cromwell Road, S.W., will be thankfully received, and duly returned after comparison and description, if necessary. RICHARD LYDEKKER

The Lodge, Harpenden, Herts, January 17

Earthquakes

EARTHQUAKE phenomena are extremely rare in this highly favoured part of the world; but we had a very decided shake near the close of the year 1882. It occurred last night (Sunday, December 31) at about five minutes past ten o'clock, Halifax time, as nearly as can be determined at present. My observation was made at Lucyfield, ten miles north from the city of Halifax; the house stands on a rounded hill formed of unaltered drift, overlying slate rock, and at an elevation of about 350 feet above sea-level.

The air was perfectly still. There was a sudden rumble as of heavy waggons on a hard road at some little distance, then the sound became louder, I may say deafening, as of heavy loaded waggons running close to the wall; or of a heavy railway train running through a reverberating cutting; then the noise seemed overhead as if caused by rolling heavy furniture on the upper floor; there was a slight vibration of the building, as if something large and heavy had struck the roof, icicles fell from the eaves, fragments of plaster fell down behind the lathing of the walls, and there was a sound like a sudden gust of wind upon the windows and walls outside (there was no wind however). Suddenly noise and vibration ceased, and all was perfectly still. Passing outside, to look for some cause for these remarkable phenomena, nothing particular was noticeable. The country was covered with a thick white mantle of snow, the air was perfectly calm, there had been no rain drops, nor hail, but a faint flash of lightning (unaccompanied by thunder) occurred about a minute and a half or two minutes after cessation of the shock.

For two or three days prior to the shock, the temperature did not fluctuate much. The thermometer stood at zero centigrade (32° F.) at sunset on the 31st and has not varied much since; it was within a degree of the same at sunset of the previous day, but went down at night, rising again in the morning. During the day (31st) the sky was clear with some light fleecy clouds, wind northerly, but veered round to south-west about sunset, and the sky became overcast with clouds; later the clouds seemed to clear away, but the air became foggy, and was so at the time of the shock. (About Truro I am informed the sky was "clear and starry.") The air had been in a highly electric state during the afternoon and evening.

The earthquake shock lasted, as nearly as I can compute from recalling circumstances, something less than a minute, certainly more than half a minute, but probably not more than a whole one. I cannot indicate with any degree of certainty the direction of oscillation; so far as a retrospect of circumstances and sensations indicate, the apparent movement was from south-west to north-east.

Most persons in the city of Halifax to whom I have spoken to day observed the shock more or less distinctly, but it does not appear to have been nearly as violent in the city as in some other places. I ascertained from the conductor of the morning railway train that the shock was felt more or less severely all along the journey traversed by his train this morning, viz. from Truro to Halifax, a distance of sixty-one miles. At Shubenacadie, nearly thirty miles from my point of observation, flower-pots in the railway station house were toppled over on the window-sill and rolled upon the floor.

I have jotted down these particulars, thinking they may possibly prove of some interest if compared with the observations of others at different points. GEORGE LAWSON

Dalhousie College, Halifax, Nova Scotia, January 1

A SHOCK of earthquake was felt in this district on Tuesday, January 16, about 5 p.m. Comparatively few persons perceived it, but to those who did it was a striking phenomenon. The following report has been handed to me by a trustworthy observer:—

"About 5 p.m. on Tuesday, January 16, I was standing in a room, leaning against the foot of an iron bedstead, and facing a window, in front of which, on a table, was a cage containing one of the small African parrakeets known as love birds. The room was perfectly quiet, when this bird, which had settled itself for the night, surprised me by craning out its neck and flattening its plumage with every appearance of alarm, without any sound or movement on my part, or anything in the room which could possibly have frightened it. Immediately afterwards the iron bedstead I was leaning against, as well as the floor, trembled sufficiently to make me wonder what on earth was going on, especially as I heard no sound sufficient to account for it. The trembling ceased in a few seconds, and, while I was still wondering, returned in a greater degree than before, lasting this time about five seconds. The feeling I experienced was similar to that of standing on a bridge while a load was passing over. The second time I speedily came to the conclusion that it was caused by an earthquake." GEORGE F. BURDER

Clifton, January 20

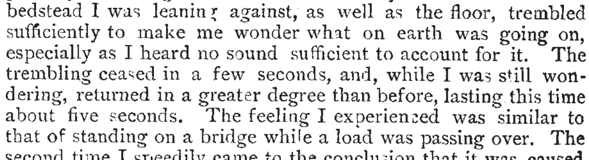
I SHALL feel obliged if you will put on record in your columns that an earthquake was felt at Hastings by my sister and myself in separate rooms, on Tuesday morning last, the 16th inst., at 9½ minutes past 9 a.m. The undulations were between E.S.E. and W.N.W., and lasted about 4 seconds. R. H. TIDDEMAN

H.M. Geological Survey, 28, Jermyn Street, S.W., Jan. 20

The Sea Serpent

BELIEVING it to be desirable that every well-authenticated observation indicating the existence of large sea serpents should be permanently registered, I send you the following particulars.

About three p.m. on Sunday, September 3, 1882, a party of gentlemen and ladies were standing at the northern extremity of Llandudno pier, looking towards the open sea, when an unusual object was observed in the water near to the Little Orme's Head, travelling rapidly westwards towards the Great Orme. It appeared to be just outside the mouth of the bay, and would therefore be about a mile distant from the observers. It was watched for about two minutes, and in that interval it traversed about half the width of the bay, and then suddenly disappeared. The bay is two miles wide, and therefore the object, whatever it was, must have travelled at the rate of thirty miles an hour. It is estimated to have been fully as long as a large steamer, say 200 feet; the rapidity of its motion was particularly remarked as being greater than that of any ordinary vessel. The colour



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